DATA MODUL

easy TOUCH

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Driverless T-Series Controller User Guide

Rev 3.1

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1 Introduction

Data Moduls new generation of easyTOUCH T-Series controllers includes a firmware that is based on a standard HID pointer device for both single- and multi-touch. Since those HID device classes are an USB.org[1] standard there is no need for any kind of additional drivers for most operating systems[2].

If the operating system includes HID multi-touch support, the controller does not need an own driver and uses the driver which is included in the OS.

Data Moduls easyTOUCH “driverless” controllers offer a very simple way to change the controller settings like adjusting touch sensitivity. By providing a configuration file which is saved on a mass storage drive on the easyTOUCH USB controller, the adjustments can be done without any additional software. Beside this the controller configuration can also be edited with the easyANALYZER software.

The controller provides different operational modes which switch between single- or multi-touch and hide or show the mass storage drive. The operational mode can be changed via the configuration file or with the easyANALYZER software.

[1] http://www.usb.org/developers

[2] Some operating systems may need a patch for internal configuration that is provided by Data Modul

2 Operational Modes

The Driverless firmware has different operational modes. Each mode is defined by its available features.

The following features are possible:

Feature	Description
MS (Mass Storage)	Allows the user to change the configuration of the touch controller using a text file (see chapter Configuration using Mass Storage Device).
ST (Single Touch HID)	In this mode the touch controller behaves like a mouse with absolute coordinates. That means that only one touch is reported from the USB controller. Use this mode for operating systems with no multi touch support. To use the right mouse click please touch the sensor for at least 1.5 seconds on the same position. **Caution**: Right-click functionality and performance may differ between operating systems.
MT (Multiple Touch HID / Digitizer)	In this mode up to 10 touches can be reported from the USB controller to the operating system. **Caution:** Use this mode only if your operating system supports the USB HID multi-touch class (see chapter operating system).
CH (Config HID)	In this mode it is possible to use the easyANALYZER software for debugging and configuration.

These are the available operational modes and their active features:

Mode	Features	Description
0		This mode shall not be used! For recovery the MS is still active in all invalid modes.
1	MS + ST + CH	Mass Storage, Single Touch and Config HID
2	MS + MT + CH	Mass Storage, Multi Touch and Config HID
7	ST + CH	Single Touch and Config HID
8	MT + CH	Multi Touch and Config HID

To change the mode see chapter “5.2 Change operational mode”.

3 Configuration using Mass Storage Device

The Driverless firmware allows the user to change the configuration of the easyTOUCH USB controller using a text file.

If the Mass Storage Interface is enabled the easyTOUCH USB controller will be detected as a composite USB device that also has a mass storage interface enabled. This mass storage interface is used like an USB stick and therefore the operating system will treat this the same way. The easyTOUCH mass storage drive has a size of 41kB and is based on a FAT file system. It contains only one file named “maxtouch.txt”.

Configuration settings can be changed by writing data into the text file. The currently active configuration can be read by opening the file.

Please note while working with the configuration file on the mass storage drive, there is **absolutely no connection** between the data that is written into the file and the data that can be read from the file. This is caused by data buffering of the operating system. After buffering the operating system overwrites the data written to the file as current content.

If the maxtouch.txt file does not show the settings that where just entered, it may be necessary to reset the controller using the reset command or restart the OS. Please consult the examples section for the needed commands.

The easiest way to edit the maxtouch.txt is to use a text editor that directly edits the file and does not create a local copy of the file and then tries to overwrite the maxtouch.txt.

Regarding writing and reading from Mass Storage Device there are some OS dependencies that must be considered:

Windows CE5/CE6/EC7

How to change a parameter on the maxtouch.txt

- Reset your embedded computer
- Do **not** open the file maxtouch.txt **directly** from the Mass Storage Device
- Copy the file maxtouch.txt from the Mass Storage Device to a local directory
- Modify and save the file **locally** (not in Mass Storage Device)
- Copy the file maxtouch.txt from the local directory back to the Mass Storage Device
- Do **not** open the file maxtouch.txt directly on the Mass Storage Device
- Reset your embedded computer for the settings to be applied

How to read the content of maxtouch.txt

- Reset your embedded computer
- Do not open the file maxtouch.txt directly from the Mass Storage Device
- Copy the file maxtouch.txt from the Mass Storage Device into a local directory
- Open your local copy of maxtouch.txt

3.1 Write User Settings

In order to write a new configuration to the controller, commands must be written into the maxtouch.txt file. Each line of the text file contains one command which ends with a RETURN. At the end of the file there must be at least one empty line. A command is usually followed by a value.

The value can be any number in the range that is shown in the table below.

<command> = <Value>

Example: “Sensitivity threshold = 20”

The following commands are supported:

Command	Description	Range	Typical Value
Sensitivity threshold	Sets the touch sensitivity threshold.	0-255	20-45
Switch X and Y	Switches X and Y orientation.	0,1	
Invert X coordinates	Inverts X coordinates.	0,1	
Invert Y coordinates	Inverts Y coordinates.	0,1	
Initial movement hysteresis	This setting is used to detect an initial movement. Setting this parameter with a high value will make the system less sensitive to non-desired small finger movements (avoiding cursor flickering). At the same time a larger finger movement will be necessary for starting the cursor to move.	0-255	2-5
Next movement hysteresis	This setting is used to detect further movement (after initial movement). Setting this parameter with a low value will increase the sensibility of the cursor in a movement.	0-255	2
Touch detection integration	This setting is used to provide detection filtering. A counter is incremented each time a touch is detected. If the counter reaches the given limit, it will be reported as touch-event to the operating system. This is very useful to supress electrical noise.	0(1), 1-255 (0 and 1 means no integration)	3
Number of reported	Defines the number of touches reported by the touch controller. Range: 1-10. In order to	1-10	10

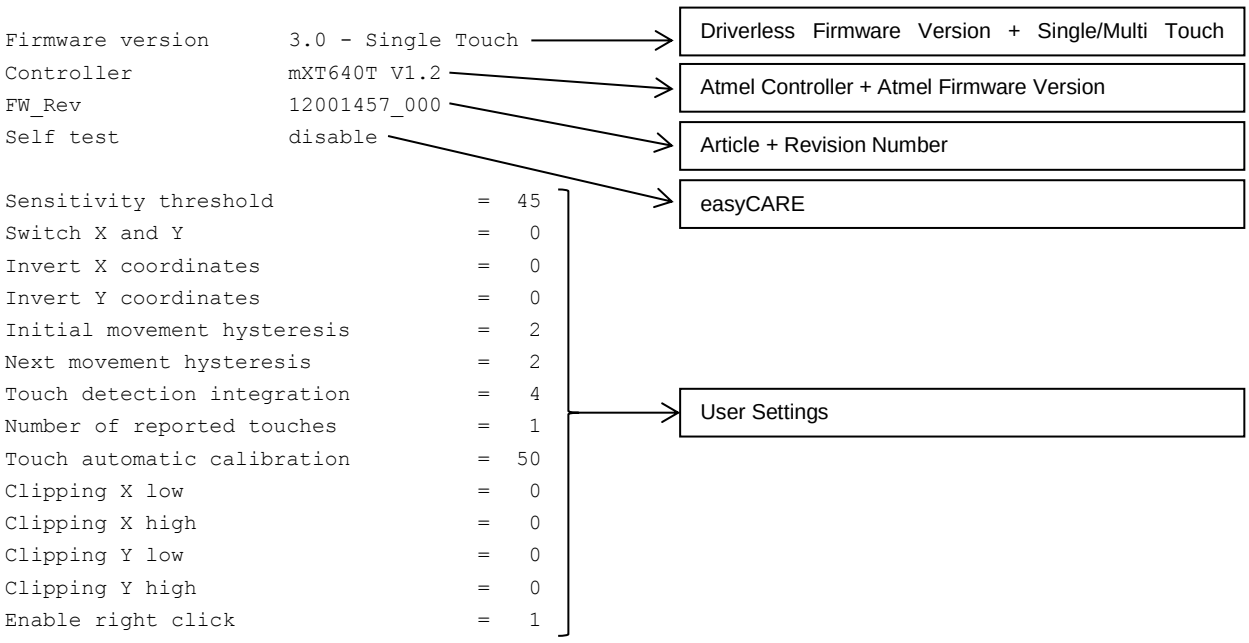
Command	Description	Range	Typical Value
touches	keep response time short, use the lowest possible value suitable for your application. In Single Touch Mode (operational mode = 1) there is only one touch reported to the operating system.		
Touch automatic calibration	Defines the duration a touch is held until it is considered as false and an automatic calibration is performed to compensate. This is useful to keep touchscreen operating when foreign objects (dirt, water drops) are located on the touch surface. After an automatic calibration the field-change at the position of the object is considered as normal, so no unexpected touch-events are generated anymore.	0 (infinite), 1-255 (in 200ms increments)	50
Clipping X low	This setting can be used to adjust the touch area (see appendix 1).	0-50 or -1 to -50	0
Clipping X high	This setting can be used to adjust the touch area (see appendix 1).	0-50 or -1 to -50	0
Clipping Y low	This setting can be used to adjust the touch area (see appendix 1).	0-50 or -1 to -50	0
Clipping Y high	This setting can be used to adjust the touch area (see appendix 1).	0-50 or -1 to -50	0
Enable right click	This setting can be used to enable right click (for Single Touch only).	0-1	1

The following commands will not be visible in the modified maxtouch.txt after a reset:

Command	Description	Range	Typical Value
reset	Resets the controller.	no value	no value
operational	Sets the operational Mode to the supplied value (see chapter operational modes).	1,2,7,8	1
debug	Displays easySETTINGS in maxtouch.txt.	no value	no value
store	Writes all easySETTINGS to the controller. Requires a reset afterwards.	no value	no value

3.2 Read User Settings

Example for the maxtouch.txt file:



4 Operating Systems

With the technology of the Driverless firmware, easyTOUCH USB controllers can be used with the most common operating systems. The following table gives an overview of the tested operating systems and the available features.

Operating System	Version	Operational Mode	Note
Win 8 32Bit	Professional	ST	
		MT	
Win 8.1 64Bit	Professional SP1	ST	Changing configuration in mass storage device may differ to other OS. Please use the easyANALYZER tool to change settings.
		MT	
Win7	Professional 32 bit / 64 bit	ST	
		MT	
Linux	Ubuntu 12.04 LTS (Precise Pangolin) 3.5.0-23-generic 32 bit	ST	Limited right click functionality may depend on used window manager and X configuration.
		MT	For multi touch under Linux please refer to the Application Note “Multitouch under Linux”[3].
WinCE 5		ST	The document touchHID_WinCE_Patch_Instalation.pdf shows how to install the Windows CE patch for Data Modul easyTOUCH using Driverless HID.
WinCE 6		ST	
WinEC 7		ST	
		MT	

[3] Application Note Implementing multi-touch using Linux

5 Examples[4]

5.1 Change sensitivity threshold

1. Open mass storage device named “Max Touch”.
2. Open the text file maxtouch.txt.
3. Edit the text file with an editor that creates no local copy of the file.
4. Now you can change the sensitivity threshold value:
   In some cases it is necessary to reset the controller to apply the new settings. For this the reset command can be used.

   Attention: It is important to press “Enter” after a new command. For some OS like Win8 64Bit it is required to replace the spaces at the end of maxtouch.txt with a new command.

```
Firmware version         3.0 - Single Touch
Controller               mXT640T V1.2
FW_Rev                   12001457_000
Self test                disable

Sensitivity threshold    =  30
Switch X and Y           =   0
…
reset\r\n     //reset the controller
```

5. Save maxtouch.txt.

5.2 Change operational mode

1. Open the text file maxtouch.txt

   Attention: It is important to press “Enter” after a new command

```
Firmware version         3.0 - Single Touch
Controller               mXT640T V1.2
FW_Rev                   12001457_000
Self test                disable

Sensitivity threshold    =  30
 ….”
operational = 1\r\n      // Single Touch HID
reset\r\n     //reset the controller
```

2. Save maxtouch.txt.

[4] Please note that this examples are tested under Windows 7 only

6 easySETTINGS support

6.1 Introduction

The driverless firmware version 3.0 or higher supports easySETTINGS controller configurations. With this feature it is possible to display the easySETTINGS in the maxtouch.txt file or to write a new configuration to the touch controller. The easySETTINGS include all controller parameters, which can be used for support requests or to copy a configuration from one controller to another.

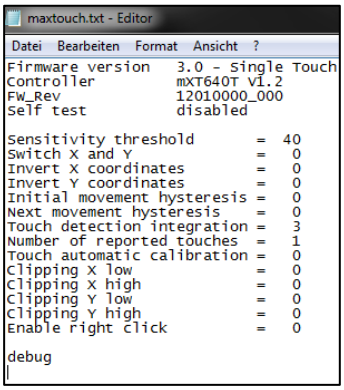
This feature is also supported in the easyANALYZER.

Attention: easySETTINGS for firmware 3.0 and 3.1 are not compatible

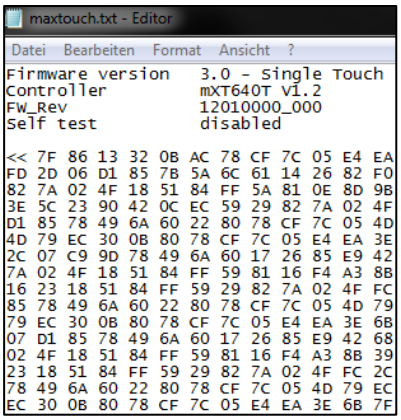
6.2 Display easySETTINGS

Displaying the easySETTINGS in the maxtouch.txt file:

1. Plug in the easyTouch controller to the PC.



2. Open the maxtouch.txt file from the mass storage device.
3. At the end of the file type: debug[return].
4. Save the file (CTRL+S or File/Save).
5. The controller is now rebooting.
6. After rebooting, the maxtouch.txt looks like this:



7. Save the easySETTINGS file to a local directory.

6.3 Save easySETTINGS to touch controller

1. Delete maxtouch.txt from the mass storage device.
2. Open the easySETTINGS file.

```
51 84 FF 59 29 82 7A 02 4F FC 2C 07 D1 85 78 49
6A 60 22 80 78 CF 7C 05 4D 79 EC 30 4D 79 EC 30
0B 80 78 CF 83 37 E5 E8 73 0A 07 DC 78 68 A4 E6
10 69 4A 9F E8 D9 7A 16 BD 97 29 82 7A 02 4E 18
35 84 9B 58 81 27 C6 90 BF 0C B1 31 2E 1A 38 51
84 FE 49 38 80 7E 00 4C EE 3F 05 D4 81 7D 5D 7F
62 24 86 7F D9 6B 07 4A 71 E5 28 54 7B E4 3A 00
9A 63 CD 75 09 E9 F6 23 69 75 F2 23 19 CE 87 73
B6 95 9F E8 D9 7A 16 BD 97 D6 7D 85 FD B0 E7 >>

store
reset
```

3. At the end of the file type: store[return] and reset[return].
4. Save the file.
5. Copy the easySETTINGS file into the mass storage device.
6. The controller is now rebooting.
7. After reboot, all controller parameters are updated.

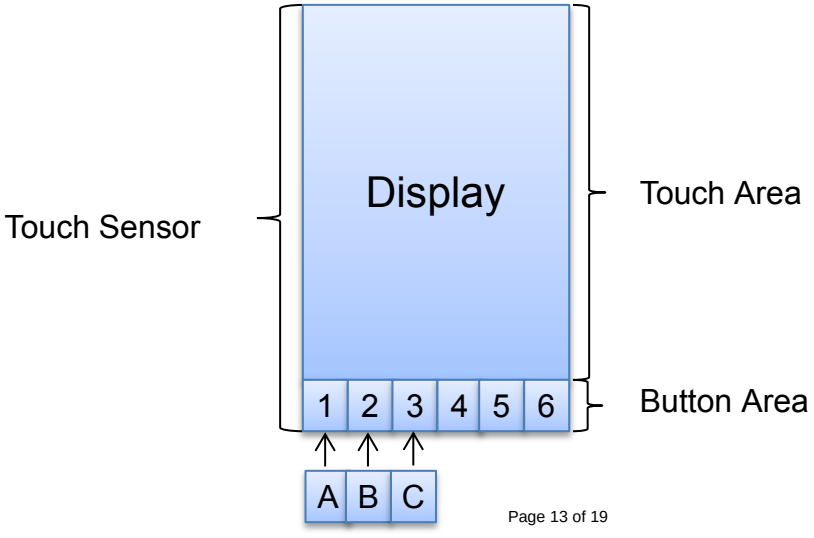
7 easyBUTTON support

The driverless firmware supports eight touch keys which can be defined along the edges of the touch sensor in special button area. Additionally to the keys a touch area can be defined for single or multi touch. EasyBUTTON support can be used with easyTOUCH T-Series which feature the Atmel mXT640T and mXT2952T2 controllers. To use easyBUTTON support, the firmware can be switched in two special operational modes. These two modes disable the mass storage device, enable ST or MT mode and a keyboard HID device. This device reports the pressed key to the host device like a common USB keyboard. Additionally there will be a special USB protocol provided by the Config HID device which allows the configuration of the keys. These enhancements are available from driverless firmware versions 3.0 and higher:

Main features:

- Unique solution for a PCAP sensor and PCAP buttons with only 1 controller
- Only 1 interface (USB) for buttons and sensor
- Up to 8 buttons configurable

For more information please contact Data Modul.

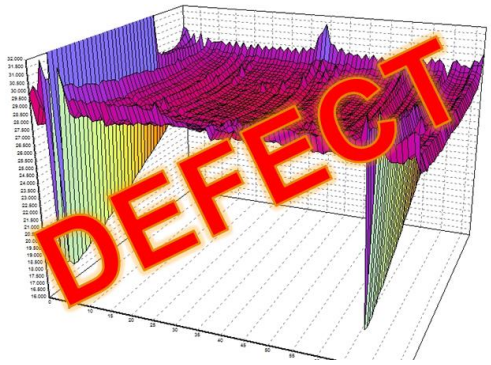


8 easyCARE

The easyCARE function tests the PCAP touch system for failure. Therefor the sensor field and the drive voltage are checked during startup of the controller. In case of an error the controller switches to a special mode and signal the fault. Two different modes can be chosen in which one completely stops the controller reporting while the other tries to get the system operable. This prevents the system to generate ghost touches or get in an unusable state if there are problems with the sensor or the controller.

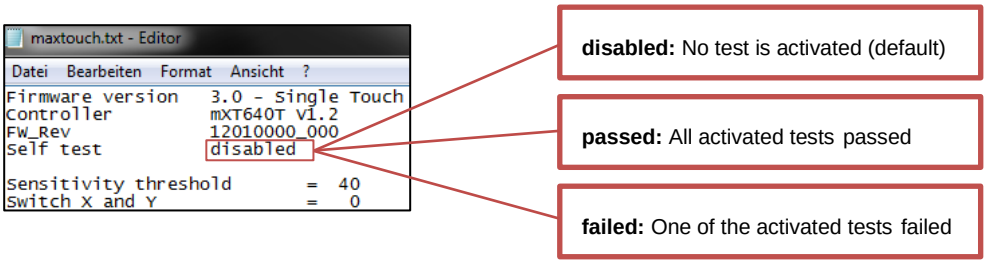
There are three tests which can be activated:

1. **Signal Limit Test**
   This test checks if the sensor reference values are in a given limit.



2. **AVDD Test**
   This test checks if AVdd or XVdd power is present.
3. **Pin Fault Test**
   This test can detect resistive line-to-line and low-resistance sensor shorts.

In maxtouch.txt file three states are printed:



If one of the tests failed, there are two operational modes selectable:

1. Complete touch system hold, no touches will be reported.
2. A warning is printed in maxtouch.txt + normal operation (if possible with defect sensor).

This feature is only available after consulting DATA MODUL.

9 easyANALYZER support

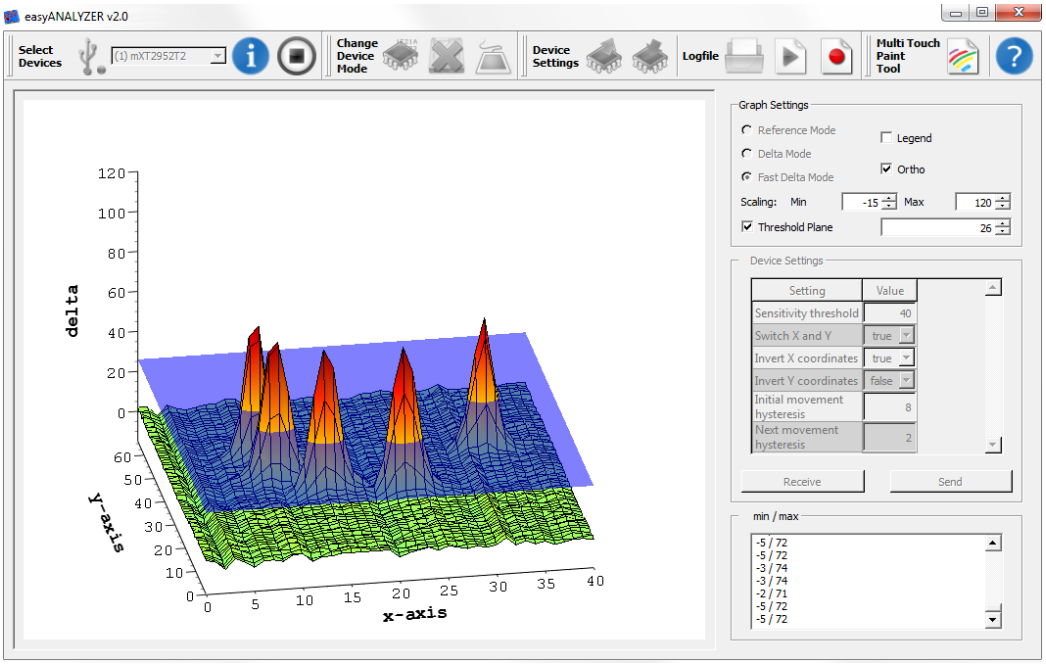
The easyANALYZER application consists of a debugging, analysis and configuration toolset for fault detection and optimization. The Driverless firmware version 3.0 or higher requires an easyANALYZER version 2.0 or higher.

The application communicates with the firmware via USB and visualizes the diagnostic data in a 3D view for interpretation.

Using easyTOUCH T-Series controllers running Driverless firmware 3.0 or higher, it is no longer necessary to switch to a special mode for using easyANALYZER. Please check the detailed description of the operational modes in chapter 2 of this document.

Main features:

- Display sensor reference values for sensor health check
- Display raw touch signals to check for noise and SNR
- Record and playback of the raw touch signals
- Recorded data file can be emailed to DATA MODUL for analysis
- Read and write basic controller settings (like in maxtouch.txt)
- Read and write easySETTINGS (complete controller settings)
- Change between single touch, multi touch
- Enable / disable maxtouch drive (mass storage drive)
- Multitouch FULL SCREEN drawing tool (only in multi touch mode)



For more information please contact Data Modul.

10 Known Issues

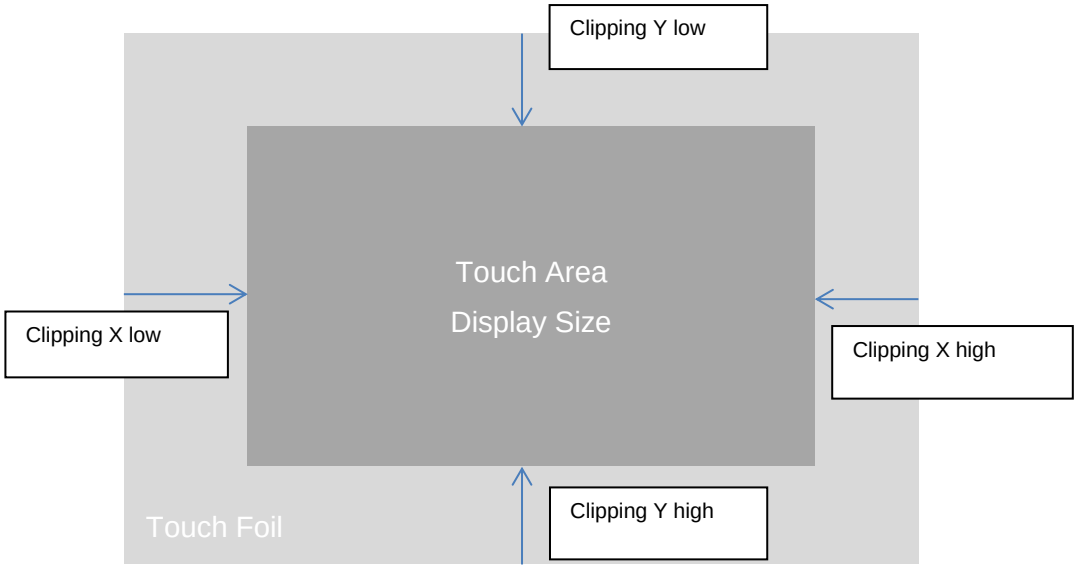
Operating System	Problem	Solution
All	2952T2-Controller: maxtouch.txt showing wrong mXT-firmware-version in debug mode (1.2 instead of 1.1)	
EC7	easySETTINGS not written to controller	The easySETTINGS-file should not be smaller than 7 kb. Please add enough spaces after the [ENTER] behind the reset-command
Linux	Two maxtouch.txts on the Mass Storage Device	Only modify or delete one of the two files

Appendix 1:

Adjust the touch area to a smaller display:

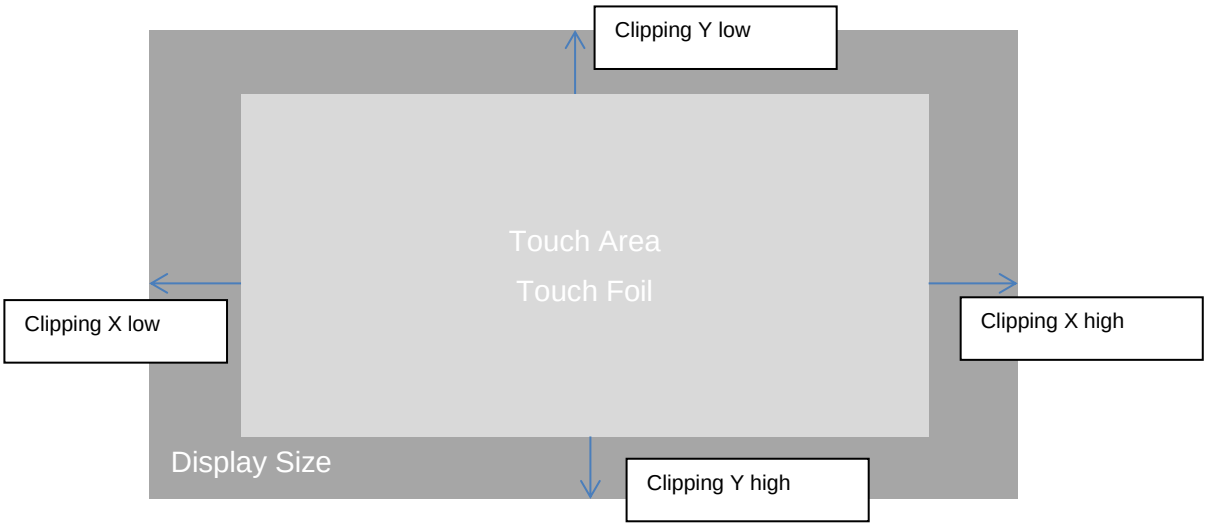
The settings (Clipping X low Clipping X high, Clipping Y low, Clipping Y high) in maxtouch.txt can be used to set up a clipping boundary. These fields allow settings in the range from -50 to 50. The maximum clipping value allows a clipping boundary one eight of the touch screen height or width. Positive values (0 to 50) increase the size of the clipping boundary. Below you can find an example to adjust a bigger touch area to a smaller display:

Example: Positive Clipping Boundary



Negative values (-1 to -50) are used for negative clipping boundary. For example to adjust a smaller touch area to a bigger display:

Example: Negative Clipping Boundary



Appendix 2:

Changes from Firmware 1.3 to 2.0

- Added easyBUTTON support
- Added easyANALYSER support
- Added easySETTINGS support
- Added easyCARE support
- Fixed multi touch right click issue

Changes from Firmware 2.0 to 3.0

- Firmware 3.0 is only available for easyTOUCH T-Series
- Firmware 3.0 based on a new Xmega microcontroller
- Config HID is available in operational mode 1 and 2

Changes from Firmware 3.0 to 3.1

- Added mXT640T-Firmware 1.5 support
- Improved easySETTINGS
- Included calibration command for easyANALYZER
- Improved multi touch task for better touch performance

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